

(12) UK Patent Application (19) GB (11) 2 285 003 (13) A

(43) Date of A Publication 28.06.1995

(21) Application No 9424799.6

(22) Date of Filing 08.12.1994

(30) Priority Data

(31) 4344128

(32) 23.12.1993

(33) DE

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(51) INT CL⁶

B23Q 11/00, B24B 23/02, B27B 5/38

(52) UK CL (Edition N)

B3B BHAX

B3D DHR D100

B5L LDS L102

(56) Documents Cited

WO 92/11972 A

US 4924636 A

US 4402241 A

US 4400995 A

US 3899852 A

US 3872951 A

(58) Field of Search

UK CL (Edition N) B3B BHAX BHALX BHAL1 B12C5,

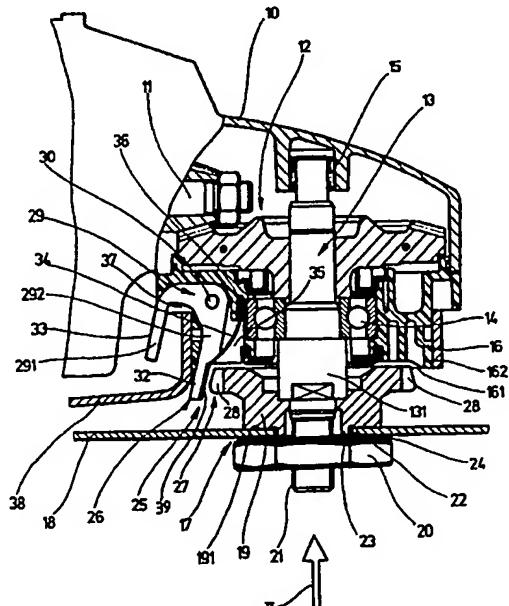
B3D DED DEM DHR DHX DJP DUX, B5L LDS LDX LMB

INT CL⁶ B23Q, B24B, B24D, B27B

ONLINE DATABASES : EDOC;WPI

(54) Spindle-arresting device in electric machine hand tool for changing rotary tool

(57) In an electric machine hand tool e.g. a right angle grinder, circular hand saw, having a workspindle (13) for driving a rotary tool (18), having a clamping device (17) connecting the rotary tool (18) non-rotatably to the drive spindle (13), and having a manually operable spindle arresting device (25) for locking the drive spindle (13) against rotation while the rotary tool (18) is being changed, there is provided a spindle arresting device (25) lying outside of the machine housing (10), the spindle-side locking element (27) of the spindle arresting device (25) being formed externally on the clamping flange (19) of the clamping device (17) and the housing-side locking element (26) of the spindle arresting device (25) being disposed on a hand lever (29), which is supported on the machine housing (10) so as to be capable of swivelling about a swivelling axis (30) directed at right angles to the spindle axis.



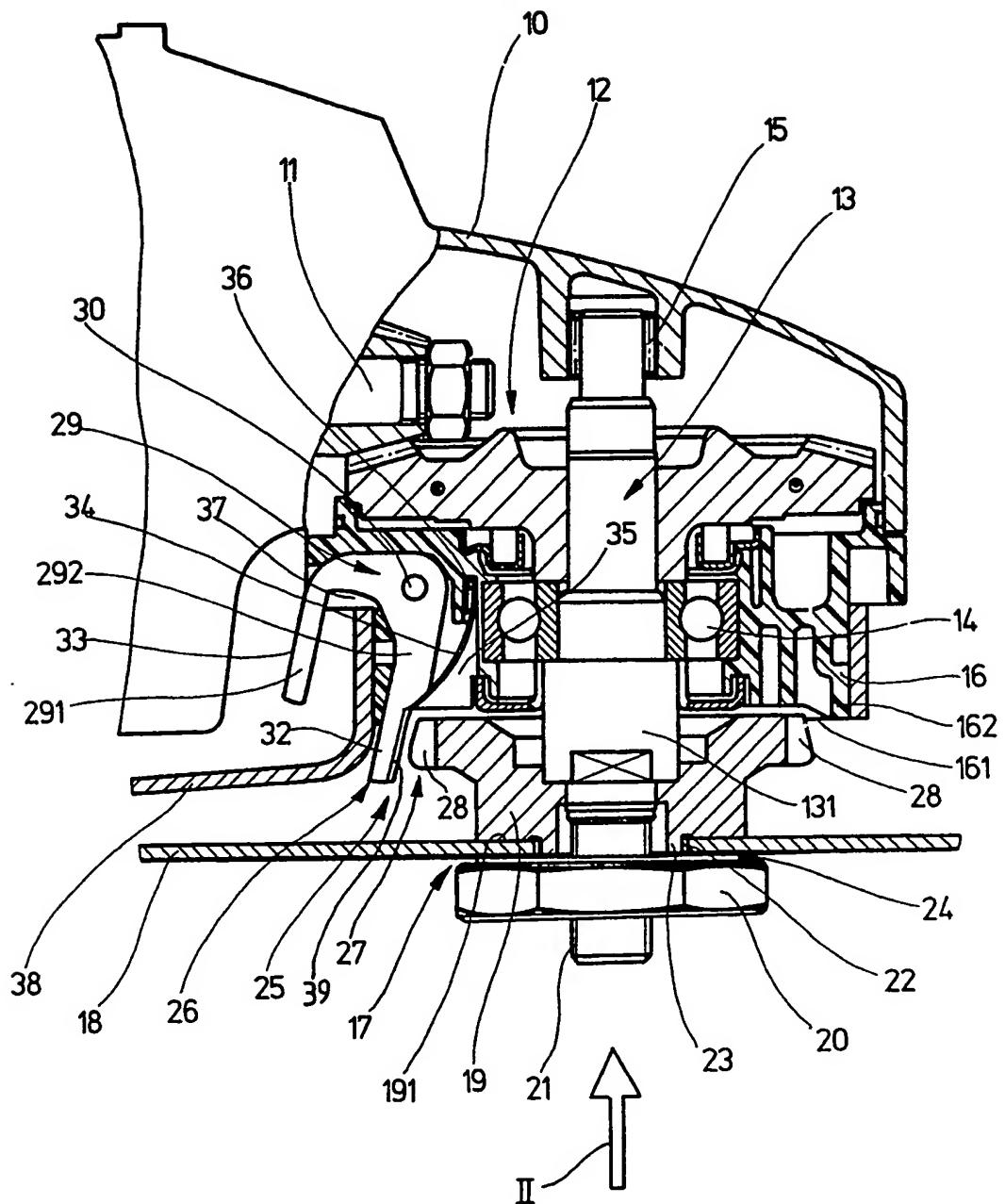


Fig. 1

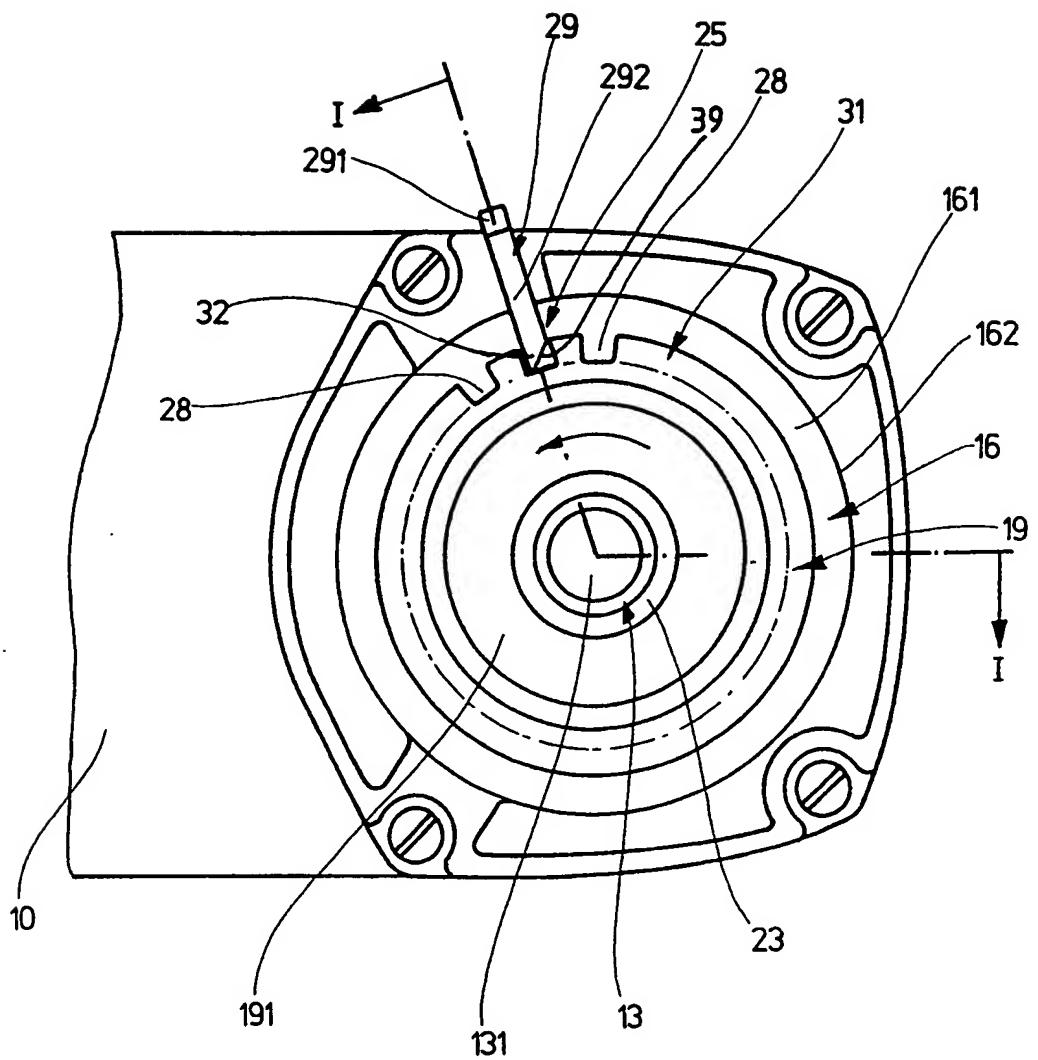


Fig. 2

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Electric machine hand tool

Background art

The invention proceeds from an electric machine hand tool having a rotating tool, e.g. right angle grinders, circular hand saws and the like, of the type defined in the preamble of claim 1.

To change the rotary tool, i.e. to mount it on, or remove it from the workspindle, the tightening nut has to be tightened or slackened, for which purpose the workspindle has to be locked against any rotation. In older machine hand tools, the projecting end of the workspindle is provided for said purpose with diametrical plane surfaces, onto which an auxiliary tool, e.g. an open-jawed spanner, may be placed to hold the workspindle fast.

For tool-free locking of the workspindle, in a known machine hand tool of the type described initially (DE 41 00 412 A1), the spindle arresting device comprises a slotted disk having two diametrical detent slots, which is seated non-rotatably on the output shaft of the electric motor, and a latching pin which may be introduced counter to a restoring spring into the detent slots. To interlock the workspindle, the latching pin may either be pressed in manually by means of a pushbutton projecting from the machine housing or it is operated, when the machine hand tool is deposited onto a standing surface provided for said purpose on the machine housing, by a plunger which projects from the standing surface and upon deposit of the machine is pushed into the machine housing. In either case, the latching pin penetrates into one of the detent slots

in the slotted disk and locks the drive shaft of the electric motor and hence, via the speed-transforming gear, the workspindle against rotation.

Said admittedly elegantly designed solution for a user-friendly, tool-free spindle arresting device has the drawback that, because of its arrangement in the housing, on the one hand it has to be sealed off from the gearing oil and on the other hand, owing to elaborate machining and assembly processes, it entails not inconsiderable additional production costs.

Advantages of the invention

In contrast, the electric machine hand tool according to the invention having the characterizing features of claim 1 has the advantage of an extremely simple construction of the spindle arresting device, which lies outside of the machine housing and does not cause any additional sealing problems. The hand lever is an inexpensive, unmachined insertion part, which is easy to assemble and may be positioned at an ergonomically advantageous point of the machine housing which does not hamper work with the machine hand tool. During slackening or tightening of the tightening nut, the hand lever is to be operated and held in its operating position. Upon letting go of the hand lever, said lever is preferably automatically reset so that spindle arresting is automatically and reliably cancelled upon letting go of the hand lever.

By virtue of the measures described in the further claims, advantageous developments and improvements of the machine hand tool indicated in claim 1 are possible.

A solution for the spindle arresting device, which is advantageous in terms of production engineering, is achieved in that the spindle-side locking element is formed by a plurality of radial indentations which are lined up, offset by

preferably identical angles at circumference relative to one another, one behind the other over the entire periphery of the clamping flange, and said radial indentations are realized by an external gearing on the clamping flange. The lever-side locking element is formed by a detent cam which, in the case of the external gearing, is the end portion of the one lever arm of the two-armed hand lever itself and may engage in a form-fit manner into the tooth spaces of the external gearing. The second lever arm is the operating part of the hand lever for swivelling said lever counter to the force of a restoring spring. The realization of the spindle-side locking element by an external gearing on the clamping flange, besides being easy to manufacture, has the added advantage that locking against rotation of the workspindle may be effected virtually in any rotational position.

According to a preferred embodiment of the invention, the machine housing has a bearing neck, which accommodates the workspindle in a bearing and has an outer annular mounting surface for a protective hood which covers the rotary tool. Introduced in the bearing neck is an axially extending recess which is open towards the face of the bearing neck directed towards the projecting end of the workspindle. The hand lever is supported by its swivelling axis in the recess in such a way that its lever arm forming the detent cam projects at the front end of the bearing neck from the recess. When in addition, according to a further embodiment of the invention, the bearing neck is a separate plastic material part and is firmly connected to the machine housing, the overall result is an inexpensive and quick-to-assemble bearing system for the hand lever on the machine housing.

Drawing

The invention is explained in greater detail in the following description of an embodiment, which is illustrated in the drawings. The drawings show:

Fig.1 in a cutout manner, a section of a right angle grinding machine according to line I-I in Fig.2,

Fig.2 in a cutout manner, a plan view of the right angle grinding machine according to arrow II in Fig.1, with the grinding wheel removed.

Description of the embodiment

The right angle grinding machine or right angle grinder illustrated as an example of an electric machine hand tool in a cutout manner in the sectional view of Fig.1 and in the inverted plan view of Fig.2 comprises a machine housing 10 accommodating an electric drive motor, of which only the output shaft 11 is shown in Fig.1, a speed-transforming gear 12 and a workspindle 13. The workspindle 13 is rotationally supported in a ball bearing 14 and a needle bearing 15, both in the form of radial bearings, the needle bearing 15 being accommodated by the machine housing 10 and the ball bearing 14 being accommodated by a bearing neck 16 made of a plastic material, which is firmly connected to the machine housing 10. The workspindle 13 projects beyond the bearing neck 16 and receives, in a clamping device 17 seated on the projecting end 131, a rotary tool 18 in the form of a cutting-off or grinding wheel. The clamping device 17 comprises a clamping flange 19, which is mounted on the projecting end 131 of the workspindle 13 and is connected in a non-rotatable and radially and axially non-displaceable manner to the workspindle, and a tightening nut 20 which may be screwed onto a threaded portion 21 on the projecting end 131. The rotary tool 18 is mounted by means of a central centring hole 22 in a form-fit manner onto a location pin 23 formed on the face of the clamping flange 19 and is pressed by means of the tightening nut 20 in a friction-locked manner against the annular end face 191 of the clamping flange 19. If necessary, a strain washer 24 may

additionally be inserted between the tightening nut 20 and the disk-shaped rotary tool 18.

To tighten and slacken the tightening nut 20, the workspindle 13 has to be locked against rotation, to which end a spindle arresting device 25 is provided which, upon operation, fixes the workspindle 13 non-rotatably on the machine housing 10. For said purpose, the spindle arresting device 25 has two locking elements 26, 27, which may be brought into engagement with one another and of which the locking element 26 is fixed on the housing side and the locking element 27 is fixed on the spindle side. The spindle-side locking element 27 is formed externally on the clamping flange 19 in the form of radial indentations 28, while the housing-side locking element 26 is disposed on a hand lever 29 which is supported on the machine housing 10 so as to be capable of swivelling about a swivelling axis 30 directed at right angles to the spindle axis. The indentations 28 are lined up, offset by identical angles at circumference relative to one another, one behind the other over the entire periphery of the clamping flange 19 and, in terms of production engineering, are realized by an external gearing 31 on the clamping flange 19, the indentations 28 being the tooth spaces. The housing-side locking element 26 on the hand lever 29 is realized by a detent cam 32 which may latch in a form-fit manner into one of the indentations 28 in the external gearing 31.

The end of the detent cam 32 carries an inclined surface 39 which, in the event of inadvertent operation of the spindle arresting device, serves as a deflection surface. By said means, unintentional locking of the workspindle 13 is prevented because the detent cam 32 is prevented from entering the indentations 28 so long as the workspindle 13 is rotating.

The hand lever 29 is a two-armed lever, the one lever arm 291 carrying an operating surface 33 for swivelling the hand lever 29 counter to the force of a restoring spring 34 and the other

lever arm 292 carrying the detent cam 32. As is evident from Figs.1 and 2, the detent cam 32 is formed by the end portion of the lever arm 292 itself, which swivels in the direction of rotation substantially without play into the indentations 28 between the teeth of the external gearing 31. The hand lever 29 is so fashioned that the lever arm 291, starting from the swivelling axis 30, first extends substantially at right angles to the lever arm 292 and is then bent through approximately 90° and extends parallel to the lever arm 292. The hand lever 29 takes the form of an unmachined injection-moulded part.

In order to support the hand lever 29 so that it is capable of swivelling on the machine housing 10, the bearing neck 16 has an axially extending recess 35 which is open towards the face 161 of the bearing neck 16 directed towards the projecting end of the workspindle 13. The hand lever 29 is then inserted into the recess 35 and fixed by the swivelling axis 30 in the bearing neck 16 in such a way that the end portion of the lever arm 292 forming the detent cam 32 projects from the recess 35. The restoring spring 34 takes the form of a leaf spring, which is held in a pocket 36 in the bearing neck 16 and is supported on the lever arm 292, applying the latter against the inner wall of the recess 35. The other lever arm 291 passes, with its arm portion extending at right angles to the lever arm 292, through an opening 37 in the bearing neck wall and extends, with its arm portion parallel to the lever arm 292, outside of the bearing neck 16 in the direction of the rotary tool 18. The operating surface 33 is provided on the outside of the arm portion remote from the bearing neck 16, thereby making it easy for the operator to place his finger on it.

Formed externally on the bearing neck 16 is an annular mounting surface 162 for a protective hood 38 which may be pushed onto the bearing neck 16. The protective hood 38 in a known manner screens off the rotary tool 18 outside of its

field of action to prevent contact by the operator. The opening 37 for passage of the lever arm 291 is disposed in the bearing neck wall in the bearing neck region lying at the side of the mounting surface 162 remote from the projecting end 131 of the workspindle 13.

When the rotary tool 18 is to be changed, first the tightening nut 20 should be slackened by means of a spanner. For this, the operator grips the lever arm 291 with one finger and exerts pressure via the operating surface 33 upon the hand lever 29. As a result, the hand lever 29 is swivelled, in Fig.1, in an anticlockwise direction counter to the force of the restoring spring 34 so that the end portion of the lever arm 292 forming the detent cam 32 is swivelled into one of the indentations 28 between the teeth of the external gearing 31. By virtue of the clamping flange 19 of the clamping device 17 being rigidly connected to the workspindle 13, the workspindle 13 is therefore locked against rotation at the machine housing 10, and the tightening nut 20 may easily be slackened using the spanner. An identical interlocking of the workspindle 13 is necessary when tightening the tightening nut 20 after the rotary tool 18 has been changed.

Claims

1. Electric machine hand tool, having a machine housing (10), a workspindle (13) projecting from the machine housing and driven by an electric motor for operating a rotary tool (18), having a clamping device (17) which connects the rotary tool (18) non-rotatably to the drive spindle (13) and comprises a clamping flange (19), which is held in a non-rotatable and radially and axially non-displaceable manner on the projecting end (131) of the drive spindle (13) for the support and/or application of the rotary tool (18), and a tightening nut (20) which may be screwed onto a threaded portion (21) of the projecting end (131) for friction-locked pressing of the rotary tool (18) against the clamping flange (19), and having a manually operable spindle arresting device (25) for locking the drive spindle (13) against rotation while the rotary tool (18) is being changed, said device comprising two locking elements (26, 27) which may be brought into engagement with one another and are fixed on the housing side and the spindle side respectively, characterized in that the spindle-side locking element (27) is formed externally on the clamping flange (19) and the housing-side locking element (26) is disposed on a hand lever (29), which is supported on the machine housing (10) so as to be capable of swivelling about a swivelling axis (30) directed at right angles to the spindle axis.
2. Machine according to claim 1, characterized in that the spindle-side locking element (27) is formed by at least one indentation (28) radially introduced in the clamping flange (19) and the housing-side locking element (26) is

formed by a detent cam (32) which engages into the indentation (28).

3. Machine according to claim 1, characterized in that a plurality of radial indentations (28) are provided, which are lined up, offset by preferably identical angles at circumference relative to one another, one behind the other over the entire periphery of the clamping flange (19).
4. Machine according to claim 2 or 3, characterized in that the hand lever (29) is a two-armed lever and that the one lever arm (291) carries an operating surface (33) and the other lever arm (292) carries the detent cam (32).
5. Machine according to one of claims 2 to 4, characterized in that the hand lever (29) is held by means of a restoring spring (34) in a normal position, in which its detent cam (32) is lifted out of the at least one indentation (28) in the clamping flange (19).
6. Machine according to claim 4 or 5, characterized in that the machine housing (10) has a bearing neck (16), which accommodates the workspindle (13) in a bearing (14) and has an outer annular mounting surface (162) for a protective hood (38), that introduced in the bearing neck (16) is an axially extending recess (35) which is open towards the face (161) of the bearing neck (16) directed towards the projecting end (131) of the workspindle (13), and that the hand lever (29) is supported by its swivelling axis (30) in the recess (35) in such a way that its lever arm (292) carrying the detent cam (32) projects at the face (161) of the bearing neck (16) from the recess (35).
7. Machine according to claim 6, characterized in that, in the bearing neck region lying at the side of the mounting

surface (162) remote from the projecting end (131) of the workspindle (13), the bearing neck wall has a radial opening (37) opening into the recess (35), and that the hand lever (29) projects with its lever arm (291) carrying the operating surface (33) through the opening (37) beyond the bearing neck (16).

8. Machine according to claim 7, characterized in that the lever arm (291) carrying the operating surface (33), from the swivelling axis (30), first extends at right angles to the other lever arm (292) carrying the detent cam (32) and then, after passing out of the opening (37) in the bearing neck wall, is bent through approximately 90° in such a way that a lever arm portion carrying the operating surface (33) extends at a distance from the mounting surface (162) substantially parallel to the other lever arm (292).
9. Machine according to one of claims 6 to 8, characterized in that the bearing neck (16) is a separate plastic material part and is firmly connected to the machine housing (10).
10. Machine according to one of claims 3 to 9, characterized in that the radial indentations (28) are realized by an external gearing (31) on the clamping flange (19) and the detent cam (32) is formed by the end portion of the one lever arm (292) itself, which may engage in a substantially form-fit manner into the tooth spaces of the external gearing (31).
11. Machine according to one of claims 1 to 10, characterized in that the housing-side locking element (26), in particular the detent cam (32), has, at the end which may engage into the indentation (28), an inclined surface (39) designed as a deflection surface in the event of

inadvertent operation of the spindle arresting device (25).

12. A machine substantially as herein described with reference to the accompanying drawings.

**Examiner's report to the Comptroller under Section 17
(The Search report)**

Application number
GB 9424799.6

Relevant Technical Fields		Search Examiner M J INSLEY
(i) UK Cl (Ed.N)	B3D (DHR, DEM, DED, DUX, DJP, DHX); B3B (BHAJ, BHAI1, BHAI2, B12C5); B5L (LMB, LDX, LDS)	
(ii) Int Cl (Ed.6)	B23Q; B24B; B24D; B27B	Date of completion of Search 13 FEBRUARY 1995
Databases (see below)		Documents considered relevant following a search in respect of Claims :- 1-12
(ii) ONLINE DATABASES: EDOC, WPIL		

Categories of documents

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| Y: | Document indicating lack of inventive step if combined with one or more other documents of the same category. | E: | Patent document published on or after, but with priority date earlier than, the filing date of the present application. |
| A: | Document indicating technological background and/or state of the art. | &: | Member of the same patent family; corresponding document. |

Category	Identity of document and relevant passages		Relevant to claim(s)
A	WO 92/11972 A	(BOSCH) see Figure 1	
A	US 4924636 A	(HOFFMAN) see whole document	
A	US 4402241 A	(BLACK & DECKER) see whole document	
A	US 4400995 A	(MILWAUKEE ELECTRIC)	
A	US 3899852 A	(THE SINGER COMPANY)	
A	US 3872951 A	(THE BLACK & DECKER)	

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